PRESS RELEASE

Postadresse: Lyoner Straße 18
60528 Frankfurt am Main
GERMANY
Telefon +49 69 756081-0
Telefax +49 69 756081-11
E-Mail presse@vdw.de
www.metav.de

From Sylke Becker
Phone +49 69 756081-33
Telefax +49 69 756081-11
Email s.becker@vdw.de

Mastery of complex manufacturing processes for electric vehicles

Solutions on display at METAV 2022

***Frankfurt am Main**, 11. April 2022 – Automobile powertrains will be electrified in the future – that is a certainty. For manufacturing companies this means placing increased emphasis on products such as gears, transmissions and fuel cells, as well as adopting new approaches in manufacturing processes. The 22nd METAV International Exhibition for Metalworking Technologies, which will be held in Düsseldorf in Germany from 21 to 24 June 2022, will allow plenty of opportunity for talking to experts in this field.*

In addition to reliable and economical manufacturing processes, the main focuses of this challenging field are on sustainability and adherence to narrow manufacturing tolerances. A number of METAV exhibitors are already successfully meeting these challenges.

Minimum vibration for longer service life and greater reliability

Complex components such as those used in electric vehicles are increasingly being milled on 5-axis machining centers (MCs) in a single setup. Optimized interaction

between the tool and the chuck is crucial if production is to remain economical. High-quality CAD/CAM systems are often involved, too. This further increases the demands on machining. "We offer the ideal tool chuck for this. It can be operated by hand without any other device," says Marc Heinrich, Sales Manager at Albrecht Präzision GmbH & Co. KG based in Wernau. The patented clamping system provides greater damping during milling, which reduces tool vibration to a minimum. This extends the service life of the tool, thus reducing costs. The clamping system has a long and slim design to increase workpiece accessibility on the modern 5-axis machining centers. A range of adaptor sleeves also allows different types of cooling – with internal and peripheral cooling or also with Coolant 2.0 for even greater cooling performance. The chuck covers clamping diameters from 2 to 20 mm and can be used for a range of different workpieces. This permits cost-effective machining of components such as motor and electronics housings, sensor brackets or the chassis.

Albrecht also has a chuck with a clamping range of 1 to 6 mm in its program for the milling of complex parts. It can be used to process small control housings or sensor brackets that need to be precision-machined, for example. The chuck is also available with internal and peripheral cooling through the available collets. In addition, it exhibits precise concentricity, even at high speeds. The Albrecht experts will be on hand at METAV 2022 to answer questions about chucks, vibration damping during milling, and increased tool life.

Process stability even with fine manufacturing tolerances

The increasing electrification of drive technology is changing the products being manufactured and the processes themselves. Such vehicles have a smaller number of shiftable speeds – and thus also gears – compared to automatic transmissions in internal combustion engines. However, this reduced number is offset by more exacting requirements in terms of geometric properties, manufacturing tolerances and surface finish. Transmission acoustics in particular are a key quality aspect in electric vehicles. In terms of gear production, this places increased demands on process stability while requiring more exacting manufacturing tolerances. These demands must be met with

appropriate machine and tool designs (e.g. combined polishing worms) or new processes. According to Dr. Jens Brimmers, head of the Gear Technology department at the Laboratory for Machine Tools and Production Engineering (WZL) of RWTH Aachen University, we are seeing significant innovations in the machining of gears with interference contours, especially in stepped planetary gears (combined processes in single setup, reduced tool diameters, etc.), internal gears, and the evaluation and avoidance of sub-micrometer waviness on tooth flanks.

Electrification is also having a decisive impact on electric motors and fuel cell production. Lightweight components now have to be manufactured efficiently and with an eye to process reliability, as demonstrated by the machining of bipolar plates for fuel cell production. Similarly, new materials are being used in broader ranges of applications (e.g. In ceramic bearings) which require the adaptation of existing manufacturing processes. At the same time, the new challenges facing industry are giving rise to new fields of scientific research. Prof. Thomas Bergs from the Chair of Manufacturing Technology at the WZL and his team are conducting research into potential electromobility applications (transmissions, e-motors, fuel cells, toolmaking, etc.). Here, the researchers of the WGP (German Academic Association for Production Technology – an association of leading production scientists) are focusing above all on the sustainability aspects of manufacturing processes.

Use of HSC milling in manufacture of bipolar plates for fuel cells

The energy required to power electric drives can also be stored in the form of hydrogen. Fuel cells are used here to convert chemical energy into electrical energy. Bipolar plates are at the heart of this technology. They form the two electrical poles of the fuel cell and determine its efficiency largely through the design of the so-called flow fields (narrow flow channels that optimize the chemical reaction).

Appropriate manufacturing technology is now required for producing these bipolar plates – typically from thin sheet steel. This involves forming processes using

sophisticated tools. The forming elements of these shaping tools are produced by HSC milling. The small radii (down to a few tenths of a millimeter) and the high surface quality (necessitating very low infeed speeds) result in machining times of dozens of hours. High-speed milling cutters from Röders GmbH in Soltau in Lower Saxony are suitable for such demanding machining operations, as they can deliver very high levels of accuracy over longer periods thanks to sophisticated temperature management. This prevents any misalignment, even during machining operations lasting more than 60 hours. This ensures the required accuracy of +/-3 µm. In addition, it allows surface finishes of under Ra 0.1 µm to be achieved. Tool wear and machining time are critical production cost factors due to the high hardness levels of the forming tools. The tool wear on Röders machines is significantly reduced by the high machine rigidity and damping, and the precise motion planning.

Loading mandrel for impregnation of electric motor stators

Electric motors consist of a rotor spinning within a stationary stator. This carries the wire winding, which is a long thin wire tightly wound on "hairpins". If a current then flows through this, it induces a magnetic field which turns the rotor. Even with the tightest winding, however, there are gaps between the windings. Impregnating the stator after winding closes these gaps and decisively improves the efficiency of the electric motor. The impregnation materials are applied at high temperatures (between 100 and 200°C) but are also highly abrasive, meaning that their application takes place in largely enclosed transfer lines. Röhm GmbH from Sontheim has developed a special loading mandrel for treating the stators in such a production plant. It is inserted into the stator by an automated device – usually a robot – and then tensioned from inside. Once the stator is tensioned on the loading mandrel, it can be fed into the transfer line. There is a steep-taper or hollow-taper interface at the end of the mandrel. This can be opened and closed pneumatically or hydraulically to grip or release the loading mandrel.

"The loading mandrel has a patent-pending self-locking mechanism which ensures that the stator remains tensioned after the mandrel is released," explains Claus Faber,

Head of Marketing and Product Management. "In the transfer line itself, the other end of the loading mandrel is clamped by a Röhm collet chuck. This allows the stator to be rotated in a defined manner during drizzling or dipping. The stator clamped on the loading mandrel can also be machined during subsequent fit grinding, thanks to the collet chuck. We will be exhibiting at METAV 2022 where we will be happy to discuss these and numerous other topics related to manufacturing technology."

Background

METAV 2022 will take place from 21 to 24 June in Düsseldorf. It will showcase the entire spectrum of production technology. The main focuses are on machine tools, tools, accessories, measuring technology, surface and computer technology for metalworking, software, machines and systems for additive manufacturing, production systems and components for medical technology. In addition, METAV 2022 will highlight specific solutions in four theme areas: Additive Manufacturing, Medical, Moulding and Quality. METAV 2020 had to be cancelled due to the COVID pandemic and was held as a digital event in 2021.

Detailed information offers and registration documents for METAV 2022 are available at www.metav.de.

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Tool clamping – crucially important

Manufacturers of electric vehicles all around the world, and their suppliers, are under pressure to produce the necessary components cost-effectively. In order to thrive in this highly competitive market, it is essential to plan the manufacturing processes

efficiently. The companies are increasingly relying on new processes, materials and components to do so. Digitalization and Industry 4.0 are growing in importance, increasing the level of networking among the machines involved and giving rise to new machine technologies. The demands on production technology are becoming ever more exacting. Ultimately it is all down to the question: What is the best and most cost-effective way to achieve high quality? The production chain usually consists of the machine tool, the workpiece, the clamping operation, the tool and, not least, the tool clamping. All these components must be carefully coordinated in order to achieve a top-quality result. This coordination mainly concerns the tool and the chucks. Chucks from Albrecht Präzision, for example, have superior damping properties, and thus help ensure long tool life and reliable processes.

Contact persons:

VDW (German Machine Tool Builders' Association)
Gerda Kneifel
Press and Public Relations
Lyoner Str. 18
60528 Frankfurt am Main
Germany
g.kneifel@vdw.de
Tel. +49 69 756081-32
www.vdw.de

Albrecht Präzision GmbH & Co.KG
Martin Schmideder
CEO
Antoniusstr. 25
73249 Wernau
Germany
info@albrecht-germany.com
Tel. +49 7153 3006-0
www.albrecht-germany.com

Röders GmbH
Dr. Oliver Gossel
Authorized representative, Sales Manager Engineering

Gottlieb-Daimler-Str. 6
29614 Soltau
Germany
gossel.oliver@roeders.de
Tel. +49 5191 603-470
www.roeders.de

Röhm GmbH
Claus Christoph Faber
Head of Marketing and Product Management
Heinrich-Roehm-Str. 50
89567 Sontheim
Germany
claus.faber@roehm.biz
Tel. +49 7325 16 588
www.roehm.biz

Laboratory for Machine Tools and Production Engineering (WZL) of RWTH Aachen University
Chair of Manufacturing Technology
Dr.- Jens Brimmers
Chief Engineer Gear Technology
Steinbachstr. 19
52074 Aachen
Germany
j.brimmers@wzl.rwth-aachen.de
Tel. +49 241 80-27416
www.wzl.rwth-aachen.de

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